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LIME REPORT

1917

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Chief Chemist



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LETTER OF TRANSMITTAL

DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY

Harrisburg, Pa., December 22, 1917.

Hon. Charles E. Patton,
Secretary of Agriculture,
Harrisburg, Pa.

Dear Sir:—I have the honor to present herewith for your approval a report of the work accomplished during 1917, which shows the result of analyses of the samples of Lime Product received from the official sampling agents.

It is recommended that this report be published in bulletin form for distribution.

Very respectfully,

JAMES W. KELLOGG,
Chief Chemist.



LIME REPORT

1917

INTRODUCTION

The inspection of lime products during 1917 resulted in the collection by the official sampling Agents of the Department of 151 samples. They were secured from the various selling agents throughout the State during the Spring and Fall seasons. Of the total number received, 129 samples were analyzed representing 50 different brands of lime products registered with the Department during the year and being sold in the State by 27 local firms and 19 companies located in other or nearby states. The samples analyzed included 7 groups or classes and these classes, together with the number of samples in each, were as follows: Pulverized Limestone, 21; Artificial Carbonate of Lime, 16; Marl, 6; Lime, 10; Hydrated Lime, 69; Gypsum or Land Plaster, 3 and 2 brands including 4 samples classed as Miscellaneous.

As the lime law requires these products to be guaranteed for the percentages contained of calcium oxide and magnesium oxide, each sample was analyzed for these elements and in addition determinations were made for the amount of insoluble matter. In the case of the carbonates of lime, including Pulverized Limestone and Artificial Carbonates, the samples were analyzed to determine the size or number of sieve mesh through which the coarsest particles would pass, which information is required to be shown for this class of products. Determinations were also made for the percentage amounts which would pass a No. 10, No. 50 and No. 100 mesh sieve. The samples of Gypsum or Land Plaster which are required to be labeled with the percentages of calcium oxide and sulphur trioxide, were analyzed for these elements. In the samples of Lime, in order to learn to what extent the process of burning had been carried in preparing lime from limestone, determinations were made for the percentage of carbon dioxide. In those brands and samples of products where the lime and magnesia were present for the most part in the form of carbonates and where the guarantees for the carbonates are also required, the amount of calcium and magnesium oxides found upon analysis were estimated in the form of carbonates. Tables have been prepared including the names and addresses of the Manufacturers, the Dealers or Selling Agents from whom the samples were secured, together with the results of the analysis of each which will be found

on the following pages. Table I includes: Pulverized Limestones, Artificial Carbonate of Lime and Marl. Table II: Lime and Hydrated Lime. Table III: Gypsum or Land Plaster, and Table IV includes the Miscellaneous samples, "Berkley Hydra-Calcite" and "Warner's 50-50 Lime."

The result of the year's work show that many deficiencies occurred in the samples examined compared with the guarantees reported and registered. A few samples were secured where guarantees were not given as required and where complete information was not furnished. In a number of cases where the amount of calcium oxide was found to be less than claimed, the content of magnesium oxide exceeded the guarantees. There were 59.5 per cent. of the samples low in calcium oxide and a smaller number or 36.8 per cent. low in magnesium oxide. In the majority of cases, as will be noted by referring to the tables, these deficiencies were not great, and this condition is probably due to lack of stating proper or correct guarantees rather than intent to not furnish lime products which would meet the guarantees claimed. As both calcium and magnesium are of value in lime products for soil amendment, where low lime and high magnesia were present, as compared with guarantees, the total amount of elements claimed were furnished, as will be also noted. It will also be observed that certain products analyzed closer to the guarantees claimed than others, thus indicating a more uniform product. There was considerable variation in the selling prices reported by the sampling agents, and these prices show further variations when the total content of calcium and magnesium oxide furnished for these prices are considered. In the case of Pulverized Limestone the lowest price was \$3.50 per ton, the highest price \$6.75 per ton and the amount of Calcium and Magnesium Oxides contained in a ton of these brands shown by the samples obtained were 925.8 and 973.2 respectively. In the case of the Artificial Carbonate of Lime, the low price of \$2.50 purchased 1097.4 lbs., and the highest price of \$10.00 bought 1076.8 lbs., the latter brand furnishing a less number of pounds than that selling at the lower figure. The brands of Marl included sold from \$6.35 to \$7.50 a ton and 962.6 lbs. and 935.8 lbs. respectively were furnished. In the case of Burnt Lime, the lowest selling price of \$3.65 purchased 1366.0 lbs. and for the highest price of \$8.25 the purchaser received 1349.6 lbs. Similar variations were also noted in the samples of Hydrated Lime where the prices ranged from \$5.65 to \$12.00 a ton. In the first case the lower figure represented a shipment which, upon analysis, showed that 1379.4 lbs. would be furnished and in the latter case, where there were two brands selling for the higher figures of \$12.00 a ton, from 1523.6 to 1572.8 lbs. of calcium and magnesium oxides were furnished the purchaser. In the case of Gypsum, the selling prices of which were from \$11.50 to

\$13.00 a ton, the amount of calcium oxide furnished would not be as great, as this class of product differs from the foregoing in that it contains a large proportion of sulphur trioxide in addition to calcium oxide.

In order that the total amount of constituents with average selling prices in the several groups of lime products may be compared, the number of pounds of calcium and magnesium oxides furnished for \$1.00 based on the average analyses and prices of each class, has been estimated as follows: Pulverized Limestone 212.3 lbs., Artificial Carbonate of Lime 139.1 lbs., Marl 137.1 lbs., Lime 218.9 lbs., Hydrated Lime 154.0 lbs., Gypsum 49.1 lbs.

In making a comparison of the composition and selling prices of the different form of lime products, the point should not be overlooked that freight rates and sources of supplies will give different results. In a case where it appears that one form of lime is cheaper to purchase because of the amount of calcium and magnesium oxides contained and a low price, it may be cheaper to purchase a brand of lime selling at a higher figure and possibly containing less elements of soil amendments because of the short haul, low freight rate, nearness of source of supply and the local requirements. Burnt Lime will, as a rule, supply a greater amount of the necessary elements, however, this class of material is not as convenient to handle and apply to the land as some of the other forms, and these requirements and conditions should be considered. Pulverized Limestone, although supplying less of the necessary elements, because of the amount of carbon dioxide contained, usually sells for a lower price than some of the other forms of lime; however, it is claimed that if limestone be sufficiently pulverized or of a degree of fineness which will make it readily active, it in many instances would be more advantageous to purchase. It will also be recognized that because of the small number of samples included in this report, the results of analyses and selling prices will not fully represent the various grades of lime products being disposed of; however, this information will indicate to what extent the brands included will analyze and the amount of elements furnished at the selling prices prevailing during the period the samples were secured.

The lime law provides for the analysis of special samples of lime products for residents of the State for a fee of \$1.00, if they be submitted in accordance with certain prescribed requirements. During the year 17 special samples of lime were received and analyzed in accordance with this provision of the law. Reports of analyses were submitted to those who sent the samples as soon as possible after they could be analyzed together with a receipt for the fees received, and the fees amounting to \$17.00 were paid to the State Treasurer

as required. The following pages include a copy of the Lime Law, which gives in detail the requirements necessary in selling lime products in the State, tables of detailed analyses together with a discussion of results of each class of products received.

ACKNOWLEDGMENTS

Mr. V. B. Hausknecht, First Assistant Chemist, had charge of the reception and preparation of samples, immediate supervision of the analytical work and the making of check determinations where necessary. The chemical analyses were made by Messrs. J. E. Shull, F. J. Holben and G. J. Kuhlman, Jr.

LIME LAW.

No. 306.

AN ACT

To regulate the sale for agricultural purposes of crushed limestone, lime, gypsum, and related products; defining said products; and prescribing penalties for the violation of this act.

Section 1. Be it enacted, &c., That every bag, barrel, or other package or quantity, of any pulverized limestone, ground oyster shells, artificial carbonate of lime, ground lime, spraying lime, slackened-lime, hydrated lime, hydrated spraying lime, marl, gypsum, or land-plaster, sold, offered, or exposed for sale, within this Commonwealth for use as a soil amendment or as an ingredient or reagent in the preparation of any fungicide or insecticide, shall have attached to it or be accompanied, in a manner provided in section three hereof, by a plainly printed statement giving the name and address of the manufacturer or importer and his place of business, the brand or trade-name of said material, the net weight of the contents of the package, when sold in package, and a statement declaring, with respect to pulverized limestone, ground oyster shells, and artificial carbonate of lime: (a) The degree of fineness of the material, in terms of the

minimum sieve-mesh, expressed in fractions of an inch, through which the coarsest particles of said material can pass; and (b) the minimum percentages contained of available oxides of calcium and magnesium, respectively, combined as carbonates; with respect to lime, ground lime, spraying lime, slacked-lime, hydrated lime, hydrated spraying lime, and marl, the minimum percentages contained of the available oxides of calcium and magnesium, respectively; and with respect to gypsum, or land-plaster, the minimum percentages contained of available calcium oxide and sulphur trioxide, or sulphuric acid (SO_3) respectively; which statement shall be held to be the guaranty of the manufacturer or importer that the goods to which said statement refers are of the kind and quality, or composition and fineness, so set forth. The provisions of this act shall not, however, apply to air-slacked lime, kiln-slaks, gas-house lime, or tanners' lime, when sold as such.

Section 2. For the purpose of this act, the materials named in the foregoing section are defined as follows:—

(1) Limestone is the rock commonly known by that name, and consisting chiefly of calcium carbonate, or of said carbonate with a smaller molecular proportion of magnesium carbonate.

(2) Pulverized limestone is limestone reduced by mechanical means to a fine powder.

(3) Artificial carbonate of lime is carbonate of lime artificially produced by any method other than the exposure of lime, ground lime, slaked-lime, hydrated lime, or spraying lime to the action of the atmosphere.

(4) Lime is the product obtained by the complete burning of limestone in a kiln, and capable of being reduced by slaking to a fine powder.

(5) Ground lime is lime reduced to a fine powder by grinding.

(6) Spraying lime is lime of high purity, containing not less than ninety-three per centum of calcium oxide and not more than five per centum of magnesium oxide, not more than five per centum of carbon dioxide, nor more than five per centum of acid insoluble matters, iron or aluminum oxides, collectively.

(7) Slaked-lime is the dry finely divided product obtained by the addition of water to lime.

(8) Hydrated lime is slaked-lime prepared by the aid of stirring, or of stirring, grinding, and screening machinery, and is free from hard lumps.

(9) Hydrated spraying lime is dry finely divided hydrated lime of purity not less, after taking the water of hydration into account, than that herein required in the case of spraying lime, and of such fineness that all shall pass a standard sieve of one hundred meshes to the inch.

(10) Air-slaked lime is the more or less finely divided product obtained when lime, slaked-lime, hydrated lime, or spraying lime is exposed for a considerable time to the action of the air.

(11) Marl is clay highly charged with carbonate of lime. Shell marl is marl in which the carbonate of lime is present chiefly in the form of molluscan shells.

(12) Gypsum, or land-plaster, is the finely divided mineral, commonly known by that name, and consisting chiefly of calcium sulphate.

(13) Kiln-slaks is refuse lime mixed with ashes and "core," or imperfectly burned limestone.

(14) Gas-house lime is spent lime that has been used as a purifier in the manufacture of illuminating gas.

(15) Tanner's lime is spent lime that has been used in the curing of hides.

Section 3. The statement required by section one of this act shall, in the case of goods sold in package, be plainly printed upon the package, or upon a tag or label fastened thereto, of such quality and in such manner that it shall not be detached in handling, and, in the case of goods sold in bulk, the said statement shall be delivered to the purchaser either with the invoice therefor or with the goods.

Section 4. Every manufacturer or importer of one or more of the materials named in section one of this act, for either or both of the purposes therein stated, shall, on or before the first day of January of each year, or before offering them for sale in this Commonwealth for either of said purposes, file annually with the Secretary of Agriculture a statement of the names and number of brands of such materials having distinct trade-names that he shall offer for sale, for either or both of said purposes, during the next ensuing calendar year or remainder thereof, together with a copy of the statement declaring the composition of these several brands of said materials, as required by section one of this act.

Section 5. In addition to the statement required by section four of this act, every manufacturer or importer of any of the materials named in section one of this act shall on or before the first day of January of each year, or before offering them for sale within this Commonwealth, file annually with the Secretary of Agriculture an affidavit showing, as nearly as practicable, the weight of each brand of said materials sold by him, or, if the producer or vendor be a firm or corporation, by its managers, officers, and agents, within this Commonwealth, for either or both of the purposes named in section one of this act, during the last preceding year; and for each brand so sold he shall pay to the Secretary of Agriculture a license fee, according to the weight sold, as follows: For an amount exceeding one hundred tons, but not exceeding one thousand tons, five dollars; for an amount

exceeding one thousand tons, but not exceeding five thousand tons, ten dollars; and for an amount exceeding five thousand tons, twenty dollars; and when said fees shall have been paid, and the statements required by section four of this act have been filed with the Secretary of Agriculture, the party or parties who have made such payment, and otherwise complied with the provisions of this act, shall be entitled to sell within the Commonwealth the goods specified in said statement and covered by said fees during the year, or fraction of a year, immediately following said statement. If the manufacturer or importer shall not have made during the preceding year any sales within the Commonwealth, for the aforesaid purposes, of any brand to be offered for sale during the year for which the fee is to be paid, he shall pay for each such brand a fee of five dollars. All moneys so received shall be immediately paid by the Secretary of Agriculture into the State Treasury, for the use of the Commonwealth.

Section 6. Any person or persons selling, offering, or exposing for sale, for either of the purposes stated in section one of this act, any of the materials named therein or brand of the same, unless accompanied by the statement required by section one of this act, or, when so accompanied, if the said statements shall be false in any particular, or without having complied with all the foregoing provisions of this act, shall be guilty of a misdemeanor; and on conviction shall be sentenced to pay a fine of not less than ten nor more than fifty dollars for the first offense, and not less than one hundred dollars for each subsequent offense. It shall be the duty of the Secretary of Agriculture to enforce the provisions of this act; and all penalties, costs, and fines received shall be paid to him or his duly authorized agent, and by him shall be immediately paid into the State Treasury, for the use of the Commonwealth.

Section 7. The Secretary of Agriculture is hereby empowered to collect samples of the materials named in section one of this act, either in person or by his duly qualified agent or representative, to have them analyzed, and to publish the results for the information of the public; and for this purpose the said Secretary of Agriculture, such assistants, agents, experts, chemists, detectives, and counsel as he shall duly authorize; shall have full access, ingress, and egress to and from all places of business, quarries, kilns, factories, barns buildings, carriages, cars, and vessels used in the manufacture, storage, transportation, or sale of any of the said materials. They shall also have power to open any package or vessel containing or supposed to contain any of the said materials, and to take therefrom samples for analysis, upon tendering the value of said samples. Any manufacturer or producer of any of the materials named in section one of this act, located in the Commonwealth, shall be entitled to have a single sample of any distinct brand, for the sale of which he has paid

the fee required by section five of this act, analyzed by the Department of Agriculture, under such regulations as the Secretary of Agriculture may prescribe with respect to the points of composition specified in said section one, upon sending sample properly sealed and carriage prepaid, together with a fee of one dollar for each such analysis; but not more than two brands shall be analyzed, under the privilege conferred by this proviso, for one manufacturer or producer in a single year. None of the provisions of this act shall apply to sales of limestone, or limestone products or marl, when such sales are made at the quarry or pit in bulk, and delivered to the wagons of the users, who are presumed to be acquainted with the qualities of the local products.

Section 8. To carry out the provisions of this act for the period ending June first, one thousand nine hundred and seventeen, the sum of four thousand dollars (\$4,000), or so much thereof as may be necessary, is hereby specifically appropriated to the Department of Agriculture.

Section 9. This act shall go into effect on the first day of January, one thousand nine hundred and sixteen.

Approved—The 1st day of June, A. D. 1915.

MARTIN G. BRUMBAUGH..

REGISTRATION

Before lime products can be sold in the State for agricultural purposes, the law requires each brand to be registered, and an affidavit filed with the Department on or before January 1st of each year. It is also necessary to pay a license fee of from five dollars (\$5.00) to twenty dollars (\$20.00), according to the number of tons sold during the preceding year. Before lime products are offered for sale, producers should make application for registration and licenses to the Secretary of Agriculture, Hon. Charles E. Patton, Harrisburg, Pa.

REQUIRED LABELING.

The requirements of the law with respect to labeling are as follows: Except in the case of air-slaked lime, kiln-slaks, gas-house lime and tanners' lime, when sold as such, all slacks or containers or attached cards, are required to be printed, or if sold in bulk, a state-

ment delivered to the purchasers, showing the number of net pounds, brand name or name of product, name and address of Manufacturer or Importer and guaranteed analysis. The guarantees required vary for each class of lime product and minimum guarantees only should be used as the use of both minimum and maximum, or so called "sliding guarantees" are considered contrary to the requirements. The guarantees required for each class of products are as follows:—

Pulverized limestone, ground oyster shells and artificial carbonate of lime: Minimum guarantees for calcium oxide and its equivalent as calcium carbonate; magnesium oxide and its equivalent as magnesium carbonate, and the degree of fineness showing the number of sieve mesh through which the coarsest particles will pass.

Lime, ground lime, spraying lime, slaked lime, hydrated lime, hydrated spraying lime and marl. Guarantees for the minimum percentages of calcium oxide and magnesium oxide.

Gypsum of Land Plaster: Guarantees for the minimum percentages of calcium oxide and sulphur trioxide.

ANALYSES OF SPECIAL SAMPLES

Under certain conditions the Department will analyze special samples of lime products for residents of the State, as provided for by the law, for the fee of \$1.00 per sample. Parties wishing to take advantage of this provision should first write to the Department making a request for the analysis of a sample and fill out and return a blank form which will be sent, together with the amount of fee charged and then should proceed as follows:

Amount of Sample:— Portions should be carefully taken from several sacks of the shipment, or if in bulk, from several different places and carefully mixed to insure as uniform and as representative a sample as can be obtained. After thoroughly mixing, at least a one-pound sample should be placed in a suitable container and sent to the Department.

Charge for Analysis:— A charge of one dollar (\$1.00) is made for each sample analyzed, determinations being made for calcium oxide, magnesium oxide and insoluble matter. The fee should be sent in the form of a check, money order or cash.

Address:—Both sample and letter enclosing fee and filled out form should be sent to the Bureau of Chemistry, Pennsylvania Department of Agriculture, Box R, Harrisburg, Pa. The name of the sender should be plainly written on the package containing sample. If more than one sample is submitted, each should be identified by a number, letter or name.

AVERAGE ANALYSES AND RETAIL PRICES

The following table shows the average results and selling prices of each class of lime products represented by the sample received during the year. The sum of the percentages of calcium and magnesium oxides indicates the amount contained in 100 lbs. and the number of pounds of these elements contained in a ton and furnished by the selling prices given can readily be determined:

Classes of Lime Products.	Number of samples.	Moisture.	Calcium oxide.	Magnesium oxide.	Sulphur trioxide.	Insoluble matter.	Price per ton.
Pulverized limestone,	21	%	%	%	%	%	\$4 61
Artificial carbonate of lime,	16	0.12	44.35	4.58	-----	9.54	7 56
Marl,	6	0.56	50.45	2.13	-----	1.33	6 89
Lime,	10	1.97	46.29	0.93	-----	6.36	6 00
Hydrated lime,	69	-----	63.07	2.59	-----	7.72	9 17
Gypsum,	3	8.56	59.71	10.89	38.66	2.54	12 00

DISCUSSION OF RESULTS OF INSPECTION

The various grades of lime products registered and sold in the State are required to be labeled with the guarantees for the minimum percentages contained of calcium oxide and magnesium oxide and in the case of Pulverized Limestone, Ground Oyster Shells and Artificial Carbonate of Lime, the percentages of these constituents combined as carbonates. In order to determine whether or not the brands represented by the samples received would meet the guarantees claimed, each sample received was analyzed for calcium oxide and magnesium oxide and also for insoluble matter, the impurities present in the form

of sand and silicia. In the case of lime, the product obtained by burning limestone which process drives off the excess carbon dioxide, determinations were made for this constituent. The information thus obtained indicates how completely the raw stone had been burned and how much of the unburned portion or "core" was present in the sample. Gypsum or Land Plaster, which for the most part is sulphate of lime, contains calcium oxide combined with sulphur trioxide, and accordingly these products were analyzed for these elements. The carbonates of lime were examined for their degree of fineness to ascertain the size of sieve mesh through which the coarsest particles would pass. In using these products, especially the pulverized limestones, it is important that they be reasonably fine in order that the calcium and magnesium oxides may readily be effective and made use of. A description of the several lime products will be found in the foregoing copy of the Law.

The results of analyses of the 21 samples of Pulverized Limestone received, representing 11 brands, varied considerably in their composition as would be expected in this class of products. Two grades of limestone are offered for sale, one carrying a large proportion of calcium oxide and a small proportion of magnesium oxide and the other having about equal amounts of these constituents, being derived from deposits known as dolomite rock. In considering the composition of the latter product, therefore, where the percentage content of calcium oxide is low compared with the former grade, the amount of magnesium oxide included should be taken into consideration, as both of these elements are of value in correcting soil acidity. In the samples carrying the larger proportion of calcium oxide, the amounts present, as found upon analyses, varied from 45.33 per cent. to 52.37 per cent., and the magnesium oxide varied from .51 per cent. to 2.88 per cent. In those samples containing the larger proportion of magnesium oxide, the variations noted were from 28.24 per cent. to 29.27 per cent. calcium oxide and from 14.3 per cent. to 19.76 per cent. magnesium oxide. The insoluble matter in this class varied from 4.10 per cent. to 16.05 per cent. The results of the test for fineness showed that 5 passed a No. 5 mesh sieve, 8 No. 10, 5 No. 20, 2 No. 30 and 1 No. 40. The average analysis of the limestones were as follows: Calcium oxide 44.35 per cent. equivalent to calcium carbonate 79.14 per cent., magnesium oxide 4.58 per cent. equivalent to magnesium carbonate 9.57 per cent., insoluble matter 9.54 per cent. The average results of the determinations for fineness showed that 99.4 per cent. passed a No. 10, 79.2 per cent. passed No. 50 and 64.3 per cent. passed No. 100 mesh sieves. The selling prices varied from \$3.50 to \$6.75 and averaged \$4.61 a ton. Of this number of samples, 12 were found to contain less calcium oxide and 8 less magnesium oxide than claimed, being, therefore, deficient in this respect, however, in several

cases, as will be noted where the calcium oxide was low, the magnesium oxide exceeded the amount claimed. These variations from the guarantees, while numerous, were not excessive.

The 16 samples of Artificial Carbonate of Lime examined, representing 6 brands, also showed a variation in their composition, the percentages of calcium oxide ranging from 39.90 per cent. to 54.29 per cent., averaging 50.45 per cent. being equivalent to 89.98 per cent. calcium carbonate. The magnesium oxide ranged from .58 per cent. to 6.28 per cent., averaging 2.13 per cent. being equivalent to 4.45 per cent. magnesium carbonate. The insoluble matter in this class of products was low, varying from .15 per cent. to 3.54 per cent., averaging 1.33 per cent. The majority of the samples passed a No. 10 mesh sieve and the average results show that the samples were fine enough for 79.6 per cent. to pass a No. 50 and 70.5 per cent. to pass a No 100 mesh sieve. The selling prices varied from \$2.50 to \$10.00 and averaged \$7.56 a ton. One-half of the number of samples, as will be noted by referring to the table, failed to met the guarantees, the remaining number exceeding the amount of calcium oxide claimed. The same proportion of deficiencies and overages occurred in the case of magnesium oxide. The widest variation from the guarantee being 3.13 per cent.

There were only 6 samples of Marl received, representing 2 brands, which, upon analysis, showed very little variation in their composition. The average analysis was as follows: Calcium oxide 46.29 per cent. equivalent to calcium carbonate 82.6 per cent., magnesium oxide .33 per cent. equivalent to 1.96 per cent. magnesium carbonate. The insoluble matter averaged 6.36 per cent. and the selling price \$6.89 a ton. All of these samples analyzed less in calcium oxide than guaranteed the greatest deficiency amounting to 5.59 per cent. The slight overages in magnesium oxide which constituent was low in this material, did not compensate for the deficiencies noted in these samples.

The 10 samples of products classified as Lime represented 9 brands and their composition was found to vary considerably, especially in their contents of calcium oxide, which ranged from 51.76 per cent. to 72.90 per cent., averaging 63.07 per cent. More than half of the samples failed to reach their guarantees, as will be noted by referring to the table, the greatest deficiency being 26.09 per cent. The magnesium oxide varied from 0.73 per cent. to 7.24 per cent., averaging 2.59 per cent., the carbon dioxide found present was from 2.24 per cent. to 22.60 per cent., averaging 10.86 per cent., indicating that the calcium oxide present was in the form of carbonates to the extent of from 5.10 per cent. to 54.43 per cent., averaging 23.35 per cent. These figures show the proportion of the original limestone which had been incompletely burned in the process of preparing lime, including a small proportion of carbon dioxide which may have been ab-

sorbed from the atmosphere where the lime had been exposed to the weather for a considerable length of time. The amount of insoluble matter in this class of material also showed a wide variation, ranging from .09 per cent. to 20.30 per cent., averaging 7.72 per cent. This information shows the proportion of the lime insoluble in acid and consequently of little value in the product for which lime is intended. The selling prices for lime were from \$3.65 to \$8.25 and averaged \$6.00 per ton.

The results of the year's inspection work shows that Hydrated Lime was being sold in greater quantities than the other forms of these materials, there being 69 samples collected by the Agents, representing 18 brands. In the samples, representing brands prepared from like deposits of limestone, the composition was more uniform than in the other classes of lime products, although two-thirds of the samples were found to contain less calcium oxide than claimed and about the same proportion exceeded their guarantees for magnesium oxide. In many cases, as will be noted, where samples were low in the former constituent, they were high in the latter, thus furnishing the approximate total amount of elements guaranteed. The calcium oxide varied from 39.73 per cent., in a high magnesium sample, to 70.94 per cent., in one containing 1.22 per cent. magnesium oxide, and averaged 59.71 per cent. The magnesium oxide ranged from 0.25 per cent. to 32.84 per cent. in a brand of dolomite origin and averaged 10.89 per cent. There was also considerable variation in the amount of insoluble matter in these samples which ranged from 0.20 per cent. to 10.18 per cent. with an average of 2.54 per cent. The prices at which these brands of Hydrated Lime were offered for sale, were from \$5.65 to \$12.00 and averaged \$9.17 a ton.

There were only 3 samples and 2 brands of Gypsum or Land Plaster received from the Sampling Agents and the results of analyses showed very little variation in their composition. The average content of calcium oxide was 29.48 per cent., sulphur trioxide 38.66 per cent., which estimated as calcium sulphate gave 65.77 per cent. The insoluble matter averaged 2.48 per cent. and the selling price \$12.00 a ton.

The 4 samples classed as Miscellaneous included 3 of the brand of Berkley Hydra-Calcite, which contained calcium oxide for the most part in the carbonate form, which had the following averaged analysis: Calcium oxide 57.29 per cent., magnesium oxide 2.03 per cent., insoluble matter 1.55 per cent., the selling price was from \$7.00 to \$10.00 a ton and averaged \$8.50. The remaining sample was Warners 50-50 Lime which upon analysis was found to exceed the guarantees, having 38.40 per cent. calcium oxide, 25.22 per cent. magnesium oxide. This brand is a mixture of pulverized limestone and hydrated lime. The selling price was \$6.85 a ton.

LIME FACTORS

In estimating the composition of the several classes of lime products, it is necessary to employ certain factors, which are derived from the chemical formulas representing them. As previously shown determinations are made for calcium oxide, magnesium oxide, carbon dioxide and sulphur trioxide. Carbonate of Lime is represented by the formula CaCO_3 , Carobnate of Magnesia by MgCO_3 , Gypsum or Calcium Sulphate by CaSO_4 , Hydrated Lime by Ca(OH)_2 , and Magnesium Hydrate by Mg(OH)_2 . To estimate the amounts of these forms or combinations the percentages of Calcium Oxide and Magnesium Oxide secured are multiplied by their respective factors. In order that these factors may be at hand for reference, they are included herewith as follows:—

Given.	Required.	Factor.
Calcium oxide,	Calcium hydrate,	1.321
Calcium oxide,	Calcium carbonate,	1.7839
Calcium oxide,	Calcium sulphate,	2.4265
Calcium hydrate,	Calcium oxide,7570
Calcium carbonate,	Calcium oxide,5606
Calcium sulphate,	Calcium oxide,4121
Magnesium oxide,	Magnesium hydrate,	1.4468
Magnesium oxide,	Magnesium carbonate,	2.0913
Magnesium hydrate,	Magnesium oxide,6912
Magnesium carbonate,	Magnesium oxide,4782
Calcium oxide,	Sulphur trioxide,	1.4265
Carbon dioxide,	Calcium carbonate,	2.2757
Carbon dioxide,	Magnesium carbonate,	1.9159
Calcium carbonate,	Carbon dioxide,4394
Sulphur trioxide,	Calcium sulphate,	1.701



TABLE I.—PULVERIZED LIMESTONE, ARTIFICIAL

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—	Moisture.
			%
PULVERIZED LIMESTONE.			
B-272	BESSEMER LIMESTONE CO., YOUNGSTOWN, OHIO. Bessemer Pulverized Limestone, -----	John W. White, Jamestown, -----	0.10
G-328	THE CARBON LIMESTONE CO., YOUNGSTOWN, OHIO. Carbon Agricultural Limestone, -----	H. D. King, Mill Village, -----	0.17
G-223	F. E. CONLEY LIME AND FERTILIZER CO., UTICA, N. Y. Raw Ground Lime (Ground Limestone), -----	F. C. Devenney, Forrest City, -----	0.15
G-253	Raw Ground Lime, -----	C. B. Tyler, Meshoppen, -----	0.05
THE EDISON LIMESTONE COMPANY, STEWARTSVILLE, N. J.			
C-224	Edison Pulverized Limestone, -----	Athens Milling Co., Athens, -----	0.12
C-309	Edison Pulverized Limestone, -----	Adolph Boettlinger, Danville, -----	0.10
C-307	Edison Pulverized Limestone, -----	Heebner & Kriebel, West Point, -----	0.05
C-291	Edison Pulverized Limestone, -----	Jonas Kunkle & Son, Orwigsburg, -----	0.10
C-203	Edison Pulverized Limestone, -----	G. A. Spencer, Dalton, -----	0.07
GENEVA LIMESTONE CO., INC., GENEVA, N. Y.			
C-194	Genevalime, -----	Roy J. Dunham, Wellsboro, -----	0.12
G. W. JOHNSTON LIMESTONE CO., NEW CASTLE, PA.			
C-269	Johnston's Pulverized Limestone, -----	John A. Day, Youngsville, -----	0.20
C-271	Johnston's Pulverized Limestone, -----	A. Miller & Co., Greenville, -----	0.17
C-330	Johnston's Pulverized Limestone, -----	A. Miller & Co., Greenville, -----	0.15
C-295	Johnston's Pulverized Limestone, -----	S. N. Moore, Echo, -----	0.15
LEHIGH PULVERIZED LIMESTONE CO., ALLENTEWON, PA.			
C-292	"Lehigh" Brand Pulverized Limestone, -----	Lewistown Grange, Tamaqua, -----	0.05
NORTHERN CENTRAL LIME COMPANY, WILLIAMSPORT, PA.			
C-226	Clover Leaf Pulverized Limestone, -----	Preston Brothers, Canton, -----	0.11
C-319	Clover Leaf Pulverized Limestone, -----	Preston Brothers, Canton, -----	0.12
SHENANGO LIMESTONE COMPANY, NEW CASTLE, PA.			
C-323	Shenango Pulverized Raw Limestone, -----	D. T. McRoberts, Enon Valley, --	0.15
THE SOLVAY PROCESS COMPANY, SYRACUSE, N. Y.			
C-238	Solvay Pulverized Limestone, -----	Brant Brothers, Halstead, -----	0.17
CHARLES WARNER COMPANY, WIL- MINGTOM, DEL.			
C-308	Pulverized Limestone, -----	William C. Ball, Media, -----	0.11
C-246	Pulverized Limestone, -----	A. F. Kimmel, Orwigsburg, -----	0.17
ARTIFICIAL CARBONATE OF LIME.			
THE COLUMBIA PRODUCTS CO., CLEVELAND, OHIO.			
C-327	Ohio Farmers Lime, -----	E. L. Smith & Co., Union City,--	0.75
C-325	Plant Lime, -----	T. R. Bolton, Cochranton, -----	0.57
C-338	Plant Lime, -----	W. H. Dunlap, Jr., Canonsburg, --	0.67
Average, -----			

CARBONATE OF LIME AND MARL.

Calcium Oxide.	Calcium Carbonate.	Magnesium Oxide.	Magnesium Carbonate.	Fineness.												Chemist's number.	
				Coarsest Particles Pass Sieve Mesh No.—				Amount of Sample Passing Sieve Meshes.									
				Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Insoluble matter.	Found.	Guaranteed.	10 mesh.	50 mesh.	100 mesh.		
%	%	%	%	%	%	%	%	%	No.	No.	%	%	%	%	Selling price per ton at place of selection.		
46.78	44.80	83.46	80.00	0.76	0.71	1.59	1.50	12.25	20	10	100.0	82.8	68.0	\$3 85	C- 272		
46.67	47.60	83.29	85.00	0.67	0.42	1.41	0.75	11.88	10	-----	100.0	98.6	82.8	4 25	C- 328		
48.57 52.37	51.50 51.50	86.68 93.44	95.50	2.88 0.80	1.30 1.30	6.01 1.67	----- 2.30	7.25 4.10	10 5	----- -----	100.0 97.6	36.8 24.8	20.8 18.0	3 52 4 50	C- 223 C- 253		
47.57 47.50 48.55 47.71 47.44	48.50 50.00 50.00 50.00 50.00	84.92 84.75 86.60 85.12 84.64	90.00 90.00 90.00 90.00 90.00	2.73 1.77 1.52 2.47 2.32	1.90 3.71 3.18 3.00 -----	5.72 3.00 3.00 5.17 4.86	1.50 10.10 9.18 3.00 3.00	7.56 10.10 9.18 9.30 8.36	10 20 20 10 20	10 100.0 100.0 100.0 100.0	96.8 96.8 93.6 92.0 97.6	80.4 82.8 74.4 72.4 84.8	5 00 4 75 5 25 6 20 3 65	C- 224 C- 309 C- 307 C- 291 C- 203			
29.26	23.00	52.20	-----	14.34	17.00	29.99	-----	16.05	10	-----	100.0	58.4	46.0	4 25	C- 194		
45.33 45.52 48.36 48.36	47.60 47.60 47.60 47.60	80.87 81.21 86.30 86.27	85.00	0.78 0.77 0.76 0.66	0.84 0.84 0.84 0.84	1.44 1.61 1.59 1.41	----- 1.50 1.50 1.50	14.22 14.18 9.10 9.10	10 5 10 5	100.0 97.2 100.0 96.0	92.8 85.2 83.6 78.4	81.6 72.0 63.2 59.2	----- 3 50 4 10 4 00	C- 269 C- 271 C- 330 C- 295			
29.06	26.56	51.85	47.43	19.76	19.43	41.33	40.75	7.30	5	-----	96.4	80.8	59.6	6 40	C- 292		
48.80 48.86	----- -----	87.08 87.18	93.00 93.00	1.47 1.59	----- -----	3.07 3.33	2.00 2.00	8.65 8.85	5 10	99.2 100.0	54.4 43.6	39.6 29.6	5 00 5 00	C- 226 C- 319			
47.12	47.60	84.07	-----	0.51	0.62	1.06	-----	11.55	30	-----	100.0	96.0	77.2	4 50	C- 323		
50.00	51.20	89.29	94.00	1.74	1.50	3.64	-----	5.90	20	20	100.0	77.6	58.4	4 00	C- 238		
29.27 28.24	29.00 29.40	52.23 50.39	----- -----	19.39 18.50	19.00 19.00	40.54 38.70	----- -----	6.20 9.30	40 30	10 100.0	98.8 98.8	89.2 90.8	6 75 3 70	C- 308 C- 246			
44.35	-----	79.14	-----	4.58	-----	9.57	-----	9.54	15	-----	99.4	79.2	64.3	\$4 61	-----		
48.20 49.40 48.42	45.00 45.00 45.00	86.01 88.15 86.19	----- ----- -----	2.97 3.73 3.46	5.00 5.00 5.00	6.21 7.80 7.24	----- ----- -----	3.40 1.35 1.10	10 10 10	100.0 100.0 100.0	84.0 84.0 80.8	72.0 74.4 70.8	\$6 80 7 84 8 50	C- 327 C- 325 C- 338			

TABLE 1.—PULVERIZED LIMESTONE, ARTIFICIAL

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—	Moisture.
C- 234	Plant Lime, -----	Mars Milling & Feed Co., Mars,--	0.50
C- 232	Plant Lime, -----	W. P. Rouse & Son, North East,	0.62
C- 296	Plant Lime, -----	Thompson & Glenn, Butler, -----	0.60
	THE FERTILE COMPANY, CLEVELAND, OHIO.		
C- 299	Lime-Fertile, -----	The I. W. Scott Co., Pittsburgh,--	0.20
	INDUSTRIAL CHEMICAL CO., NEW YORK, N. Y.		
C- 236	I-C-Co. Precipitated Agricultural Lime,	Alfred Baver, Kutztown, -----	0.60
C- 261	I-C-Co. Precipitated Agricultural Lime,	H. F. Gump & Son, Everett, -----	0.57
C- 245	I-C-Co. Precipitated Agricultural Lime,	Kamerer Hardware Co., Lehighton, Punxsutawney Lumber & Supply Co., Punxsutawney.	0.62
C- 334	I-C-Co. Precipitated Agricultural Lime,	E. A. Slagle, Paxinos, -----	0.52
C- 229	I-C-Co. Precipitated Agricultural Lime,	R. J. Toepper, Tarentum, -----	0.55
C- 214	I-C-Co. Precipitated Agricultural Lime,	I. D. Williams, Ariel, -----	0.45
C- 222	I-C-Co. Precipitated Agricultural Lime,		0.62
	MELVILLE-CORBETT COMPANY, ST. MARYS, PA.		
C- 265	Lime for the Farm, -----	Wm. M. Farnham, Smethport, ---	0.71
	NORWICH CHEMICAL COMPANY, EAST SMETHPORT, PA.		
C- 268	Norwich Carbonate of Lime, -----	Wm. M. Farnham, Smethport. ---	0.42
	MARL.	Average, -----	0.56
	CONNEAUT LAKE MARL COMPANY, HARMONSBURG, PA.		
C- 273	Conneaut Marl Lime, -----	King Planing Mill & Supply Co., Grove City.	2.07
C- 331	Conneaut Marl Lime, -----	King Planing Mill & Supply Co., Grove City.	1.65
C- 219	Conneaut Marl Lime, -----	H. J. Klingler & Co., Butler, ---	1.42
	INTERNATIONAL AGRICULTURAL CORPORATION, CALEDONIA, N. Y.		
C- 270	Lime Carbonate, -----	John Burgstrom, Sugar Grove, ---	1.40
C- 326	Lime Carbonate, -----	W. R. Grove, Diamond, -----	1.20
C- 310	Lime Carbonate, -----	H. A. Snyder, Strawberry Ridge, --	4.09
		Average, -----	1.97

CARBONATE OF LIME AND MARL—Concluded.

Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Insoluble matter.	Fineness.						Selling price per ton at place of selection.	Chemist's number.
									Coarsest Particles Pass Sieve Mesh No.—	Amount of Sample Passing Sieve Meshes.						
% 49.70	% 45.00	% 88.68	% 80.00	% 3.13	% 5.00	% 6.55	% 11.00	% 1.00	No. 10	% 100.0	% 80.4	% 65.2	\$ 7.50	C- 234		
% 50.15	% 45.00	% 89.49	% 80.00	% 3.01	% 5.00	% 6.29	% 11.00	% 1.15	No. 10	% 100.0	% 78.0	% 65.2	\$ 7.60	C- 232		
% 49.13	% 45.00	% 87.66	% 80.00	% 3.55	% 5.00	% 7.42	% 11.00	% 2.34	No. 10	% 100.0	% 82.4	% 71.2	\$ 9.00	C- 296		
39.90	35.84	70.83	-----	6.28	4.96	13.13	-----	3.54	10	10	100.0	74.8	58.0	-----	C- 299	
51.47	54.60	91.83	97.50	0.83	0.58	1.74	1.22	1.90	10	-----	100.0	89.6	82.0	-----	C- 236	
52.79	54.60	94.18	-----	1.05	0.58	2.19	-----	1.69	10	-----	100.0	89.6	82.0	-----	C- 261	
52.59	54.60	93.83	-----	0.76	0.58	1.58	-----	0.58	20	-----	100.0	94.4	92.0	\$ 8.50	C- 245	
51.66	54.60	92.16	-----	0.79	0.58	1.65	-----	1.70	20	-----	100.0	94.8	90.0	\$ 10.00	C- 334	
52.45	54.60	93.60	97.50	0.82	0.58	1.71	1.22	1.45	10	-----	100.0	94.8	90.4	\$ 8.00	C- 229	
52.34	54.60	93.40	97.50	0.91	0.58	1.89	1.22	0.50	20	-----	100.0	96.0	94.0	\$ 8.00	C- 214	
52.34	54.60	93.40	97.50	1.01	0.58	2.11	1.25	0.15	10	-----	100.0	86.4	84.0	\$ 8.00	C- 222	
52.32	54.93	93.34	-----	1.20	0.95	2.46	-----	0.36	5	-----	92.0	30.4	15.6	\$ 3.60	C- 265	
54.29	46.90	96.86	-----	0.58	0.95	1.21	-----	0.30	5	-----	88.4	30.0	15.6	\$ 2.50	C- 268	
50.45	-----	89.98	-----	2.13	-----	4.45	-----	1.33	10	-----	98.8	79.6	70.5	\$ 7.56	-----	
46.94	50.00	83.75	95.00	0.76	0.05	1.59	-----	5.55	-----	-----	-----	-----	-----	\$ 6.50	C- 273	
45.15	50.00	80.58	-----	0.80	0.05	1.67	-----	5.80	-----	-----	-----	-----	-----	\$ 7.00	C- 331	
44.41	50.00	79.25	95.00	0.91	0.05	1.89	-----	9.50	-----	-----	-----	-----	-----	\$ 7.50	C- 219	
47.49	50.00	84.73	-----	1.96	1.15	4.09	-----	5.38	-----	-----	-----	-----	-----	\$ 6.50	C- 270	
47.44	50.00	84.65	-----	0.69	1.15	1.44	-----	6.80	-----	-----	-----	-----	-----	\$ 6.35	C- 326	
46.32	50.00	82.64	-----	0.47	1.15	1.08	-----	5.15	-----	-----	-----	-----	-----	\$ 7.50	C- 310	
46.29	-----	82.60	-----	0.93	-----	1.96	-----	6.36	-----	-----	-----	-----	-----	\$ 6.89	-----	

TABLE II.—LIME AND

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From--
	LIME.	
C- 259	S. W. BARRICK & SONS, WOODSBORO, MD. Barrick's Agricultural Lime, -----	Edward W. Miller, New London, -----
C- 218	BEAVER VALLEY LIME CO., ELLWOOD CITY, PA. Beaver Valley Ground Burned Lime, -----	Thompson & Glenn, Butler, -----
C- 267	CRESCENT PORTLAND CEMENT CO., WAMPUM, PA. Ground Lime, -----	Kribbs & Ray, Kellettvile, -----
C- 279	KEYSTONE LIME CO., ELK LICK, PA. Alfalfa Brand Granulated Burned Lime, -----	N. B. Shober, Garret, -----
C- 318	HENRY KILGUS, MUNCY, PA. Muncy Lime Run of Kiln, -----	N. J. Morton, New Albany, -----
C- 196	W. E. McCONNELL, HUGHESVILLE, PA. Agricultural Lime, -----	J. M. Wood, -----
C- 244 C- 281	QUARRYVILLE LIME & STONE CO., QUARRYVILLE, PA. Quarryville Ground Lime, ----- Quarryville Ground Lime, -----	A. H. Burkholder, Quarryville, ----- A. H. Burkholder, Quarryville, -----
C- 340	M. E. REEDER, MUNCY, PA. Freshly Burned Chippewa Lump Lime, -----	William Price, Dallas, -----
C- 205	RUTHERFORD BROTHERS, PAXTANG, PA. Run of Kiln Lime, -----	A. E. Willier, Hegins, ----- Average, -----
	HYDRATED LIME.	
C- 339	AMERICAN LIME & STONE CO., TYRONE, PA. Hydra-Oxide (H-O) of Lime for Agricultural Use.	J. G. Cover, Masontown, -----
C- 240	Hydra-Oxide (H-O) of Lime for Agricultural Use.	Dickey Hardware Co., Lock Haven, -----
C- 225	Hydra-Oxide (H-O) of Lime for Agricultural Use.	Farmers Commercial & Consumers Union, Troy.
C- 263	Hydra-Oxide (H-O) of Lime for Agricultural Use.	Lloyd Griffith, Osterburg.
C- 318	Hydra-Oxide (H-O) of Lime for Agricultural Use.	B. J. Hartline, Montgomery.
C- 215	Hydra-Oxide (H-O) of Lime for Agricultural Use.	McFarland Supply Co., Greensburg.
C- 235	Hydra-Oxide (H-O) of Lime for Agricultural Use.	G. W. Martin & Co., Saltsburg.
C- 300	Hydra-Oxide (H-O) of Lime for Agricultural Use.	A. B. Myers, Coburn.
C- 333	Hydra-Oxide (H-O) of Lime for Agricultural Use.	Punxsutawney Lumber & Supply Co., Punxsutawney.
C- 277	Hydra-Oxide (H-O) of Lime for Agricultural Use.	G. P. Toryer, Lajose.
	BEAVER VALLEY LIME CO., ELLWOOD CITY, PA.	
C- 324	Beaver Valley Hydrated Lime, -----	Andy Moore, Enon Valley.
C- 216	Beaver Valley Hydrated Lime, -----	Morrow & Buxton, Valenciea.

HYDRATED LIME.

Calcium Oxide.		Magnesium Oxide.		Carbon dioxide.	Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
Found.	Guaranteed.	Found.	Guaranteed.				
%	%	%	%	%	%		
66.24	90.00	7.24	-----	8.30	4.30		C- 259
55.91	70.00	1.20	1.10	11.16	9.99	\$7.50	C- 218
66.36	45.90	1.12	0.22	7.84	2.00	8.25	C- 267
65.64	70.00	2.86	1.50	13.80	3.70	6.75	C- 279
72.90	79.48	0.73	1.33	2.24	6.10	5.00	C- 318
57.48	83.57	0.82	1.65	22.60	0.09	3.65	C- 196
51.76 62.79	50.00 50.00	1.78 2.36	2.00 2.00	12.36 5.42	20.30 15.55	6.50 7.50	C- 244 C- 281
65.87	85.00	1.33	1.00	14.64	12.46	5.00	C- 340
66.39	60.00	6.48	12.00	10.20	2.80	3.87	C- 205
63.07	-----	2.59	-----	10.86	7.72	\$6.00	-----
65.87	67.50	2.23	-----	-----	3.55	\$10.00	C- 239
66.17	67.50	1.67	-----	-----	7.75	9.00	C- 240
58.75	67.50	3.63	-----	-----	4.40	8.00	C- 225
63.06	67.50	1.54	-----	-----	3.42	8.00	C- 263
65.78	67.50	1.74	-----	-----	3.65	10.50	C- 313
67.97	67.50	1.00	-----	-----	2.85	9.00	C- 215
65.50	67.50	2.28	-----	-----	3.50	9.00	C- 235
65.17	67.50	2.32	-----	-----	2.84	9.00	C- 300
63.22	67.50	2.19	-----	-----	7.00	10.00	C- 333
67.34	67.50	1.30	-----	-----	1.85	8.30	C- 277
60.39 55.83	57.69 57.69	0.76 0.94	1.10 1.10	-----	4.80 6.25	7.40 8.00	C- 324 C- 216

TABLE II.—LIME AND

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—
C- 280	BLAIR LIMESTONE CO., MARTINSBURG, W. VA.	S. S. Ream, Somerset, -----
C- 336	Opequon Hydrated Lime, -----	S. S. Ream, Somerset, -----
C- 335	CENTRE COUNTY LIME CO., BELLEFONTE, PA.	Punxsutawney Lumber & Supply Co., Punxsutawney.
C- 283	Pure Hydrated Drilling Lime, -----	
C- 209	G. & W. H. CORSON, PLYMOUTH MEETING, PA.	
C- 283	Corson's Prepared Lime (Hydrated), -----	John W. Root, Kimberton, -----
C- 209	Corson's Prepared Lime (Hydrated), -----	Charles Shoehultz, Roekport, -----
C- 293	KNICKERBOCKER LIME COMPANY, PHILADELPHIA, PA.	
C- 282	Kniekerbocker Hydrated Lime, -----	Kamerer Hardware Co., Lehighton, -----
C- 284	Kniekerbocker Hydrated Lime, -----	Musselman Brothers, New Holland, -----
C- 221	Kniekerbocker Hydrated Lime, -----	Pennock Pyle, Hamorton, -----
C- 200	Kniekerbocker Hydrated Lime, -----	J. A. Reeser, Gap, -----
C- 306	LEGORE COMBINATION LIME CO., LEGORE, MD.	Sehwoyer & Sehwoyer, Robesonia, -----
C- 305	Legore's Refined Hydrated Lime, -----	
C- 305	JOHN MEEHAN & SON, PHILADELPHIA, PA.	
C- 243	Hydrated Lime, -----	H. F. Bergey, Hatfield, -----
C- 190	PALMER LIME & CEMENT CO., NEW YORK, N. Y.	
C- 304	Challenge Brand Hydrated Lime, -----	George Bard, Leaeoek, -----
C- 250	Challenge Brand Hydrated Lime, -----	Chambersburg Fertilizer Works, Chambersburg.
C- 258	Challenge Brand Hydrated Lime, -----	Samuel Dull, New Cumberland, -----
C- 286	Challenge Brand Hydrated Lime, -----	J. C. Libe & Co., Stewartstown, -----
C- 206	Challenge Brand Hydrated Lime, -----	Oxford Grain & Hay Co., Oxford, -----
C- 255	Snow Flake Hydrated Lime, -----	Oxford Grain & Hay Co., Oxford, -----
C- 230	Snow Flake Hydrated Lime, -----	E. J. Rupp, Sunbury, -----
C- 208	Snow Flake Hydrated Lime, -----	Charles H. Cox & Bro., Phoenixville, -----
C- 204	Snow Flake Hydrated Lime, -----	D. W. & H. W. Grove, Catawissa, -----
C- 289	Snow Flake Hydrated Lime, -----	Reuben Reday, Lorane, -----
C- 320	PARAGON PLASTER & SUPPLY CO., BLOOMSBURG, PA.	S. K. Savidge, Valley View, -----
C- 252	Paragon Hydrated Lime, -----	H. G. Stamm, Benville, -----
C- 294	Paragon Hydrated Lime, -----	
C- 290	PHILADELPHIA LIME CO., PHILADELPHIA, PA.	
C- 276	Hydrated Lime, -----	O. P. Beebe, Montrose, -----
C- 332	ROSE POINT STONE & LIME CO., NEW CASTLE, PA.	J. H. Hortnan, Hopbottom, -----
C- 251	Peerless Hydrated Lime, -----	Lakeside Grange, Mahanoy City, -----
C- 290	Peerless Hydrated Lime, -----	F. F. Dreibelbis & Co., Vlrginville, -----
C- 276	Peerless Hydrated Lime, -----	Hibner Hoover Hardware Co., DuBois, -----
C- 332	Peerless Hydrated Lime, -----	Hibner Hoover Hardware Co., DuBois, -----
C- 251	Peerless Hydrated Lime, -----	A. J. Steele, Latrobe, -----

HYDRATED LIME--Continued.

Calcium Oxide.		Magnesium Oxide.					Selling price per ton at place of selection.	Chemist's number.
Found.	Guaranteed.	Found.	Guaranteed.	Carbon dioxide.	Insoluble matter.			
%	%	%	%	%	%			
61.86	65.00	4.35	5.00	4.50	7.35	C- 280		
64.77	65.00	1.27	5.00	4.25	8.55	C- 336		
67.51	67.00	0.77	1.38	1.60	10.00	C- 335		
43.11	42.00	29.80	27.00	2.92	11.00	C- 283		
54.88	42.00	21.59	27.00	1.38		C- 209		
48.15	45.00	30.49	30.00	1.00	12.00	C- 293		
48.37	45.00	32.52	30.00	0.90	10.00	C- 282		
48.92	45.00	32.84	30.00	1.52	10.85	C- 284		
46.83	45.00	31.86	30.00	1.30	8.00	C- 221		
47.03	45.00	27.28	30.00	2.05	8.00	C- 200		
55.81	55.00	5.10	1.00	5.80	10.50	C- 306		
39.73		29.24		7.96	5.65	C- 305		
67.24	70.00	5.94	3.00	0.80	7.10	C- 243		
70.02	70.00	3.06	3.00	0.70	9.50	C- 190		
69.09	70.00	3.84	3.00	0.22		C- 304		
63.83	70.00	9.38	3.00	1.04	8.00	C- 252		
68.22	70.00	5.54	3.00	0.35	10.00	C- 258		
66.70	70.00	6.54	3.00	1.10	11.00	C- 286		
64.20	70.00	8.56	3.00	0.51	8.50	C- 206		
55.06	65.00	16.48	3.00	2.40	11.50	C- 255		
61.34	65.00	10.32	3.00	2.10	8.50	C- 230		
59.59	65.00	10.11	3.00	2.09	7.75	C- 208		
58.69	65.00	10.27	3.00	2.25	7.50	C- 204		
53.31	65.00	20.16	3.00	2.72	10.25	C- 289		
63.44	63.67	1.41	2.00	3.25	9.50	C- 320		
61.03	63.67	2.06	2.00	3.16	7.50	C- 252		
57.47	63.67	3.56	2.00	6.20	8.50	C- 294		
48.59	46.00	29.77	32.00	1.08	9.25	C- 290		
54.95	60.00	0.80		8.90	10.50	C- 276		
53.74	60.00	1.01		10.18	10.00	C- 332		
59.40	60.00	1.15	1.50	5.26	9.00	C- 251		

TABLE II.—LIME AND

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—
C- 329	THE SCOTIO LIME & STONE CO., DELAWARE, OHIO.	
C- 337	Clover Grower Agricultural Lime, -----	E. J. Cass, Harbor Creek, -----
	Clover Grower Agricultural Lime, -----	Dorsey Brothers, West Brownsville, -----
C- 302	SECURITY CEMENT & LIME CO., HAGERSTOWN, MD.	
C- 210	Berkeley Hydrated Lime, -----	Wm. M. Atkinson, McVeytown, -----
C- 297	Berkeley Hydrated Lime, -----	Charles Bruner, New Bloomfield, -----
C- 217	Berkeley Hydrated Lime, -----	Harmony Cereal Mills, Harmony, -----
C- 303	Berkeley Hydrated Lime, -----	Morrow & Buxton, Valenela, -----
C- 260	Berkeley Hydrated Lime, -----	Nickels & Stewart, Shippensburg, -----
		Harvey G. Shortridge, Kelton, -----
C- 193	STEACY & WILTON CO., WRIGHTSVILLE, PA.	
C- 241	"Sterling" Brand Hydrated Lime, -----	W. H. Fogelsonger, Shippensburg, -----
C- 298	"Sterling" Brand Hydrated Lime, -----	G. Denton Myers, East Berlin, -----
C- 285	"Sterling" Brand Hydrated Lime, -----	G. Denton Myers, East Berlin, -----
C- 314	"Sterling" Brand Hydrated Lime, -----	Oxford Grain & Hay Co., Oxford, -----
		George M. Walter, Milton, -----
C- 191	TIDEWATER PORTLAND CEMENT CO., BALTIMORE, MD.	
	Tidewater Hydrated Lime, -----	Chambersburg Fertilizer Works, Chambersburg, -----
C- 212	Tidewater Hydrated Lime, -----	Grove & Uffleman, Parke, -----
C- 256	Tidewater Hydrated Lime, -----	W. H. Walker & Co., Kennett Square, -----
C- 220	Tidewater Hydrated Lime, -----	J. C. Walker & Sons Co., Gap, -----
C- 202	CHARLES WARNER COMPANY, WILMINGTTON, DEL.	
C- 254	Cedar Hollow Limoid, -----	The Abington Lumber Co., Inc., Dalton, -----
C- 239	Cedar Hollow Limoid, -----	J. P. Fisher, Boyertown, -----
C- 248	Cedar Hollow Limoid, -----	E. W. Jaekson, Susquehanna, -----
C- 257	Cedar Hollow Limoid, -----	Lewistown Grange, Tamaqua, -----
C- 288	Cedar Hollow Limoid, -----	Milhous Brothers, Mendenhall, -----
C- 311	Cedar Hollow Limoid, -----	Schwoyer, Savage & Co., Robesonia, -----
C- 242	Cedar Hollow Limoid, -----	C. L. Shipman, Hughesville, -----
C- 321	Cedar Hollow Limoid, -----	J. C. Snavely & Sons, Landisville, -----
		Summit Lumber Co., Clarks Summit, -----
		Average, -----

HYDRATED LIME—Concluded.

Calcium Oxide.		Magnesium Oxide.						Chemist's number.
Found.	Guaranteed.	Found.	Guaranteed.	Carbon dioxide.	Insoluble matter.	Selling price per ton at place of selection.		
%	%	%	%	%	%			
66.04	50.00	7.79	2.00	-----	1.00	10 50	C- 329	
65.86	50.00	6.38	2.00	-----	1.00	9 40	C- 337	
67.05	70.00	2.14	2.00	-----	1.18	8 75	C- 302	
69.15	70.00	2.19	2.00	-----	0.25	8 00	C- 210	
70.74	70.00	1.92	2.00	-----	0.30	10 25	C- 297	
69.49	70.00	1.52	2.00	-----	0.20	8 00	C- 217	
70.94	70.00	1.22	2.00	-----	2.04	-----	C- 303	
68.99	70.00	1.09	2.00	-----	0.30	10 00	C- 260	
67.00	70.00	4.15	2.00	-----	1.75	8 25	C- 193	
67.38	70.00	3.19	2.00	-----	1.55	7 75	C- 241	
65.98	70.00	6.66	2.00	-----	2.06	10 00	C- 298	
60.54	70.00	10.66	2.00	-----	2.24	11 00	C- 285	
68.01	70.00	5.00	2.00	-----	1.60	10 30	C- 314	
69.07	71.00	0.25	0.50	-----	1.65	9 50	C- 191	
67.75	71.00	0.60	0.50	-----	1.15	9 50	C- 212	
70.52	71.00	0.29	0.50	-----	1.35	10 00	C- 256	
70.56	71.00	2.78	0.50	-----	1.40	8 00	C- 220	
44.96	42.00	30.78	28.00	-----	1.40	8 60	C- 202	
47.55	42.00	32.05	28.00	-----	1.40	8 50	C- 254	
47.00	42.00	30.35	28.00	-----	1.70	10 50	C- 239	
48.26	42.00	28.37	28.00	-----	1.72	7 50	C- 248	
46.29	42.00	31.36	28.00	-----	1.00	10 00	C- 257	
46.72	42.00	31.32	28.00	-----	1.56	10 00	C- 288	
45.54	42.00	30.64	28.00	-----	1.45	12 00	C- 311	
45.09	42.00	29.44	28.00	-----	1.65	7 50	C- 242	
46.03	42.00	30.31	28.00	-----	1.10	10 00	C- 321	
59.71	-----	10.89	-----	-----	2.54	\$9 17	-----	

TABLE III.--GYPSUM

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—
C- 207	THE AMERICAN AGRICULTURAL CHEMICAL CO., NEW YORK, N. Y. Ground Land Plaster, -----	I. M. Sheetz, Sunbury, -----
C- 228	Ground Land Plaster, -----	W. S. Stuart, Carlisle, -----
C- 192	BAUGH & SONS COMPANY, PHILA- DELPHIA, PA. Baugh's Pure Ground Land Plaster, -----	D. M. Wertz & Co., Quincy, Average, -----

OR LAND PLASTER.

Calcium Oxide.				Sulphur Trioxite.					
Moisture.		Found.	Guaranteed.	Found.	Guaranteed.	Gypsum (Estimated CaSO_4).	Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
%	%	%	%	%	%	%			
12.80	31.20	30.48	40.48	45.00	68.86	2.36	\$11 50	C- 207	
2.88	30.08	30.48	41.95	45.00	71.36	1.90	13 00	C- 228	
10.00	27.17	32.00	33.56	46.00	57.09	3.18	11 50	C- 192	
8.56	29.48		38.66		65.77	2.48	\$12 00		

TABLE IV.—MISCELLA

Chemist's number.	Name of Manufacturer and Brand.	Sample Taken From—
C-301 C-316 C-249	SECURITY CEMENT AND LIME COMPANY, HAGERSTOWN, MD. Berkeley Hydra-Calcite, ----- Berkeley Hydra-Calcite, ----- Berkeley Hydra-Calcite, -----	Walter Book, Port Royal, ----- Charles Huston & Bro., Three Springs, --- J. C. Libe & Co., Stewartstown, ----- Average, -----
C-201	CHARLES WARNER COMPANY, WILMINGTON, DEL. Warner's 50-50 Lime, -----	The Abington Lumber Co., Inc., Dalton,--

NEOUS SAMPLES.

Moisture.	Calcium Oxide.		Magnesium Oxide.		Insoluble matter.	Selling price per ton at place of selection.	Chemist's number.
	Found.	Guaranteed.	Found.	Guaranteed.			
%	%	%	%	%	%	\$8 50	C- 301
0.12	57.16	20.00	1.54	2.00	1.96	10 00	C- 316
0.02	58.11	20.00	1.41	2.00	1.10	7 00	C- 249
	56.60	20.00	3.15	2.00	1.60		
0.07	57.29		2.03		1.55	\$8 50	
	38.40	33.00	25.22	24.00	2.20	6 85	C- 201

